



DYMATICA

Dynamic Multi-scale Assessment Tool for Integrated
Cognitive-behavioral Actions

OVERVIEW

DYMATICA is a computational assessment capability designed to help decision makers better understand and anticipate the interplay between individuals, governmental organizations, and general society in response to specific courses of action and events. The intent is to minimize undesirable consequences by providing a more systematic analysis of decisions within state and non-state entities.

STRUCTURE & PROCESS

DYMATICA uses a hybrid, cognitive-agent based, system dynamics modeling approach to analyze various internal and external influences and interactions between key actors. The intent is to indicate likely behavioral patterns in response to actions and events. Economic drivers, military postures, political norms, social data/information, guidance from subject matter experts (SMEs), and other relevant inputs are used to populate DYMATICA models.

The DYMATICA structure and model-building processes are underpinned by a specific combination of well-established psychological, social, and economic theories of decision making, as well as established techniques in knowledge elicitation, statistics, system dynamics modeling, uncertainty quantification, and sensitivity analysis. Computational social modeling is not an exact science, but it can improve our understanding of likely outcomes, allowing for higher confidence in both strategic and operational planning and assessment.

IMPACT

DYMATICA can help organizations develop, understand, and compare likely effects of potential courses of action (COA) under a variety of geopolitical scenarios. It supports hypothesis generation and COA development, analysis, and comparison, while accounting for uncertainty in the environment. It also can aid in the forecasting of political/social/military trends shaping the future operating environment. Moreover, it can address how changes in economic circumstances, military capabilities, geopolitical positioning, and socio-political conditions are likely to affect a country's stability and ability to project power over time.



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laboratory for uncertainty
quantification, risk assessment,
and verification and validation
of computational models.*



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APPLICATION

Since 2008, DYMATICA models have assessed a variety of topic domains and country regions from around the world. These assessment domains include hybrid warfare activities like cyber messaging and deception, internal stability, migration, and propensity for aggressive behaviors. The models have assessed different geopolitical and socio-cultural narratives regarding the internal perceptions of a country's status, capabilities, and hegemony over other countries within a region. This involves the modeling of Political, Military, Economic, Social, Information, Infrastructure (PMESII) factors associated with a country's economic and military capabilities, as well as their self-perceptions, behavioral tendencies, and internal political dynamics from specific social and political organizations and their leaders. Funding partners include the United States' Department of Defense (DoD), the United Kingdom's Ministry of Defence, the intelligence community, the Department of Energy, along with Sandia's internal, laboratory-directed research and development funds.

Example Applications

- 1. Impact of Hybrid Activities on Populations & Governments** – Simulated the effects of hybrid warfare attacks on specific infrastructure networks that also included messaging campaigns on vulnerable populations and governments. The simulation couples DYMATICA with power, transpiration, food, oil/gas networks and a social medial model to represent intentional, random, and 'acts of God' disruptions, misinformation/disinformation, political policies, and military campaigns designed to affect specific populations within a country. The simulation time horizon is one year with half-a-day increments.
- 2. Effects of Strategic Messaging on Populations** – Assesses which and how specific strategic messages will separately affect different organizations and populations. DYMATICA analyzed how different violent extremist organizations respond to various messages (and their combinations) over time and how their behaviors affect their relationship with the population.
- 3. External Violence and Impacts on the Stability of a Country** – Assessed how violent spillover effects from areas near a country will likely affect a population's affinity towards NATO over time, along with the general stability of that country. DYMATICA assessed how spillover violence can differently increase the pressure on a society and how both internal policies and external pressures can either increase or decrease the overall stability of that country.



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